

NCDOI OSFM Evaluation Services

Scope of DOI White Paper: The Purpose of this document is to provide clarification on North Carolina State Code requirements to Code Officials (CEO) who are agents for the Authority Having Jurisdiction (AHJ).

DOI File #: WP-060-11

Edition Date: October 4, 2011; revised: June 22, 2012

Subject of White Paper: Fireblocking

Contents

1.0	Fireblocking, draftstopping or firestopping	1
A.	Fireblock	1
B.	Firestop	2
2.0	Reason for fireblocking	2
3.0	Examples of where Fireblocking is used	2
4.0	Types of material used as fireblock	3
5.0	T and F ratings	4
6.0	Testing Done	4
A.	What is ASTM E 84 (UL 723)?	5
B.	What is ASTM E 814 (UL 1479)?	5
C.	What is ASTM E 119 (UL 263)?	5
D.	What is UL 1715?	6
E.	What triggers the time for a F/T ratings	6
F.	What establishes equivalence when foam is used?	7
7.0	Technical References	7
8.0	Photo Resources	7

- 1.0 Fireblocking , Draftstopping or Firestopping,** People in the building industry believe these terms to be interchangeable, and or to be one and the same. However, their use and purpose is very different.
- A. **Fireblock** is a material whose main purpose is to be used in concealed locations of combustible construction to prevent fire from quickly spreading through these spaces. Such a material will, as an inherent characteristic, also slow the migration of smoke throughout the building. Fireblock is typically applied in a horizontal position to prevent the spread of fire (and thus air) in a vertical manner.

- B. **Draftstop** is a material whose main purpose is to be used in concealed locations of combustible construction to prevent the movement of slow air (oxygen) within open or concealed areas. Similar to firestopping, such a material will, as an inherent characteristic, also slow the migration of smoke throughout the building. Draftstopping is typically applied in a vertical position to prevent the spread of air in a horizontal manner (think compartmentation), within concealed spaces such as attics, crawlspaces, floor-ceiling and/or roof-ceiling assemblies.
- C. **Firestop** material is tested and approved for use in a specific construction detail that reflects the installed assembly, meant to protect rated penetrations by pipe, wire, etc., to the same degree as the fire-rated wall, ceiling or floor that is being penetrated.

2.0 Reason for fireblocking

- A. In combustible construction, such as Type III and Type V, fireblocking is installed to cut off concealed openings (vertical) and forms an effective barrier between floors or between a top story and a roof or attic space. Vertical concealed spaces (balloon construction, where the vertical space between the studs are open to the adjacent floors) without fireblocking act as a chimney, allowing smoke and flames to spread to adjacent walls and floor spaces. (Figure 1)
- B. Oversized concealed spaces or adjoined concealed spaces that allow fire to spread are difficult for the fire departments to bring under control. Fireblocking can slow a hidden fire.
- C. The proper design and installation of fire blocking ultimately helps slow the spread of fire, and thus provides more time for occupant egress.

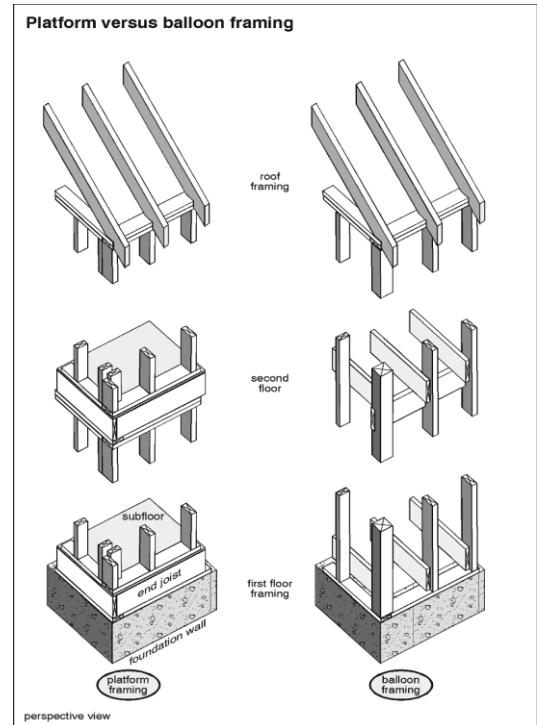


Figure 1- Platform vs. Balloon Framing

*Editorial: A firefighter's worst nightmare. In older homes, with balloon framing, a coin or stone can be dropped from the attic down the space between the studs and it would end up in the basement. Newer platform construction utilizes top and bottom wall plates creating separate sealed compartments between each floor. Because a **fireblock** deters the upward spread of fire, it could mean the difference between losing a room versus losing an entire house.*

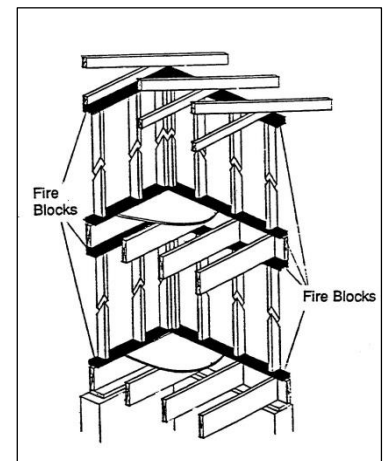


Figure 2- Fireblock

3.0 Examples of where Fireblocking is used

- Separate open vertical spaces from open horizontal spaces, (Figure 2)
- The top and bottom of stairs, between stringers,
- Within architectural trim, such as furred out wall finishes, wainscoting, soffits, siding,

etc., (Figure 3)

- Sleeper spaces, such as a raised floor,
- Fill in spaces at floor and/or ceiling in fire-partitions constructed of combustible materials,
- Unrated membrane penetrations, such as when a hole for a pipe or duct is cut out too large to be filled properly with **firestop** material, the excess area can be filled with non-combustible **fireblock**, and then the annular area around the pipe/duct is filled with **firestop** material. (Figure 4)

4.0 Types of material used as fireblock

A. As per 2012 North Carolina Building Code (NCBC), Section 717.2.1 Fireblocking shall consist of:

- 2-inch (51 mm) nominal lumber
- two thicknesses of 1-inch (25 mm) nominal lumber with broken lap joints
- one thickness of 0.719-inch (18.3 mm) wood structural panel with joints backed by 0.719-inch (18.3 mm) wood structural panel
- one thickness of 0.75-inch (19 mm) particleboard with joints backed by 0.75-inch (19 mm) particleboard.
- one-half-inch (12.7 mm) gypsum board
- one-fourth-inch (6.4 mm) cement-based millboard
- Batts or blankets of mineral or glass fiber or other approved materials installed in such a manner as to be securely retained in place.

B. As per 2012 North Carolina Residential Code (NCRC), Section R302.11 [R602.8.1] Fireblocking shall consist of:

- Two-inch (51mm) nominal lumber.
- Two thicknesses of 1-inch (25.4mm) nominal lumber with broken lap joints.
- One thickness of 23/32-inch (18.3 mm) wood structural panels with joints backed by 23/32-inch (18.3 mm) wood structural panels.
- One thickness of 3/4-inch (19.1 mm) particleboard with joints backed by 3/4-inch (19.1 mm) particleboard.
- One-half inch (12.7 mm) gypsum board.
- One-quarter inch (6.4 mm) cement-based millboard.
- Batts or blankets of mineral wool or glass fiber or other approved materials installed in such a manner as to be securely retained in place.

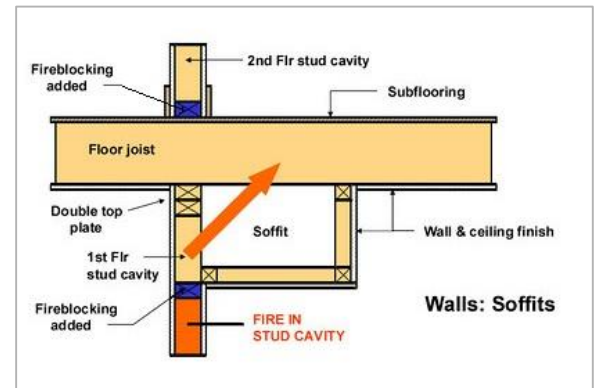


Figure 3– Fireblock at Soffits

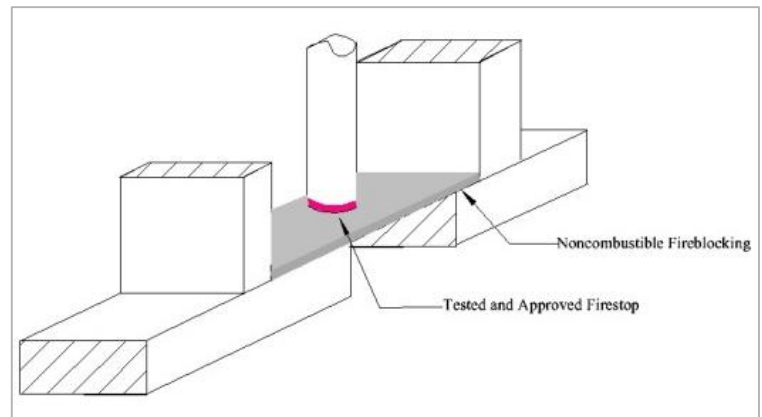


Figure 4 - Membrane Firestop with non-combustible fireblocking

5.0 T and F ratings

- A. What are T and F ratings? T and F ratings are not applicable to **Fireblock** products; they apply only to **Firestop** products, which are tested to resist the passage of fire traditionally around penetrating items such as pipes or wires. (Figure 5) Their definitions can be found in the NC Building Codes and are reprinted below.

1. **F RATING.** *The time period that the through-penetration firestop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814 or UL 1479.*
2. **T RATING.** *The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325°F (163°C) above its initial temperature through the penetration on the nonfire side when tested in accordance with ASTM E 814 or UL 1479.*
3. **THROUGH-PENETRATION FIRESTOP SYSTEM.** *An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations. The F and T rating criteria for penetration firestop systems shall be in accordance with ASTM E 814 or UL 1479. See definitions of “F rating” and “T rating.”*

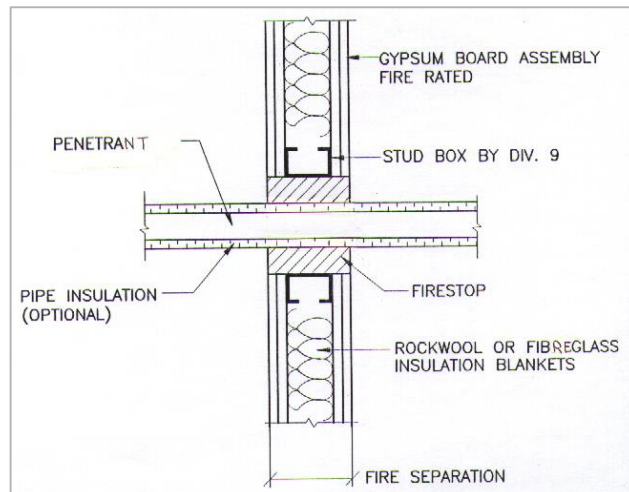


Figure 5- Firestop System

(Note: See NCBC Sec. 717.5 Exception 6 and 719.7 for limitations on use of pipe insulation)

6.0 Testing Done-

Testing for these products is done in accordance with American Society for Testing and Materials (ASTM) or Underwriter Laboratories (UL) standards.

- A. What is ASTM E84 (UL 723)? **Standard Test Method for Surface Burning Characteristics of Building Material**
1. ASTM E84 (UL 723) is specified by the code as the test to assess the contribution of surface finishes on walls and ceiling to fire loading. ASTM E84 (UL 723) does not measure heat transmission to determine fire resistance ratings or if the material should be classified as non-combustible. This test is often referred to as the “tunnel test”.
 2. The test is a comparative test intended to measure the propagation of flame from an ignition source along a specified length of the material and compare the distance of propagation to a reference material, red oak. ASTM E84 (UL 723) is an industry standard for defining how a product performs when tested for surface flame spread. The result of the test is based on a scale that compares the surface burning to select

grade red oak, which is rated 100. A product that has a flame spread of 25 has a surface burning spread 25% of red oak. A test report for a product may also include the smoke developed index, which is required to be less than 450.

3. A full length, full width specimen is attached to the ceiling of a nominally 24 foot long by 18 inch wide duct with a gas burner at one end. Airflow, calibrated to spread the flame the full length of a red oak specimen in 5 ½ minutes, is introduced, and the burner ignited. Distance the flame spreads in 10 minutes is measured, and flame spread is calculated from formulas included in the test standard.
4. ASTM E84 (UL 723) does not measure heat transmission to determine fire resistance ratings or if the material should be classified as non-combustible.

B. What is ASTM E 814? **Standard Test Method for Fire Tests of Penetration Firestop Systems** [equivalent to UL 1479 **Fire Tests of Through-Penetration Firestops**]

1. ASTM E814 [UL1479] is a test that measures how long a **firestop** assembly can withstand the effects of a fire that simulates a flashover condition. In addition, the test also measures if the **firestop** system will remain in place when exposed to a hose stream.
2. It is important to note that the Modified ASTM E814 is conducted without the hose stream test.
3. The UL 1479 test includes two optional protocols for evaluating the L rating and W rating. These protocols are not included in the ASTM E814. The L rating is a measure of airflow through a firestop system. The W rating is the used to evaluate a through-penetration firestop system's water resistance.

C. What is ASTM E119 (UL 263) ? **Standard Test Methods for Fire Tests of Building Construction and Materials**

1. Fire resistance ratings required by the NCBC for wall assemblies, floor/ceiling assemblies, roof/ceiling assemblies, and individual structural members are established by or based on testing in accordance with ASTM E 119. The term “assembly” refers to a collection of components, structural and non-structural, arranged in a specific way. Fastening of components in an assembly is limited to the tested fastening method and arrangement. Ratings on assemblies may be required by the code to prevent structural collapse, to compartmentalize a building, to protect an element of an egress system, or some combination of the three. Individual structural members, beams and columns, are typically required to be rated in certain types of construction to prevent structural collapse.
2. An assembly or structural member is placed in a flat furnace in either the horizontal or vertical position, depending on in service use. If the specimen is a load-bearing element, a specific load is imposed on the specimen. The specimen is, then, subjected to a controlled flame introduced from one side of the assembly, simulating exposure conditions during in-service use and producing temperatures increasing to a maximum along a specific time-temperature relationship. Columns are exposed to the heat source on all sides to simulate actual in-service use. Testing continues until one of the following three failure modes is observed:
 - a. Structural collapse occurs, or

- b. The temperature measured on the unexposed surface of the assembly exceeds 250°F. This criterion is a measure of heat transmission through the assembly, or
 - c. Cotton waste placed on the unexposed side of the assembly ignites. This criterion is a measure of the passage of flame and hot gases through the assembly.
- 3. Classification of the assembly is reported in hours based on the duration of the test.
 - 4. ASTM E119 (UL 263) does not test for performance of a material's suitability to be used as a **fireblock** material or surface burning characteristics.

D. What is UL 1715? **Fire Test of Interior Finish Material**

- 1. UL 1715 is also known as the "room corner test". This test simulates a fire started in a corner of a room and measures how long it will take to spread up and out. The test specimen is placed within a corner constructed with two 4 foot wide by 8 foot tall wall panels. It is intended for use in the evaluation of the flammability contribution of wall material assemblies, ceiling material assemblies, or both, exposed to early fire growth under specified room fire exposure conditions. The effectiveness of fire barrier materials as protection for other combustible materials or components within the assembly is of primary interest for this evaluation.
- 2. This test is required by 2012 NCRC, Section R316.4 Thermal Barrier; and 2012 NCBC, Section 2603.4 Thermal Barrier.

E. What triggers the time for a F/T ratings

- 1. **Firestop** to maintain the integrity of a rated assembly, an item that penetrates a floor or horizontal fire separation must have an "F" and a "T" rating not less than the fire-resistance rating for the fire separation, but not less than 1-hour. If a **firestop** system has an "F" rating of 2 hours and a "T" rating of 15 minutes, this assembly has an "F/T" rating of 15 minutes, not 2 hours. The "F" and "T" ratings are not separable. The ratings are expressed as the lowest of both the "F" and "T" ratings.
- 2. In firewalls or vertical fire separations, the **firestop** assembly only has to meet the "F" rating, which is equivalent to the rating of the wall assembly.

F. What establishes equivalence when foam is used?

- 1. Polyurethane foam (PU) is an organic plastic polymer. It is considered to be combustible and will burn in the presence of sufficient heat and/or ignition, as it has a flame spread index of less than 25 and a smoke-developed index of less than 450 when tested in accordance with ASTM E84 (UL 723). The addition of an inorganic material, such as mineral wool, is usually needed to be able to pass the flame spread test. As per current model building codes through-penetration **firestop** materials are to be tested according to ASTM E814 (UL 1479). Most polyurethane foams are tested to a modified version of ASTM E814 and, thereby may only be used as an alternate material and method with careful consideration of test reports regarding the differences between the two tests and with the approval of the local certified building official (CEO).

2. Polyurethane foam is also limited in its use as a **fireblock** material for the same reasons stated above. In addition to being tested to the modified version of ASTM E814, some test reports require the presence of a 15-minute thermal barrier. Further, while the maximum width is limited to 1 5/16 inches, the thickness can range from 1 ½ inches to 3 inches depending on the manufacturer.

7.0 Technical References

- [UL 1715](#)
- [ASTM E84-2007](#)
- [ASTM E119-2007](#)
- [ASTM E814-2006](#)
- [UL1479](#)
- [ESR-3165](#)
- [ESR-1961](#)
- [UL 723](#)
- [UL 263](#)

8.0 Photo Resources

Figure 1 [Platform vs. Balloon framing](#)

Figure 2- [fireblocking](#)

Figure 3- [Fireblock at Soffits](#)

Figure 4- Membrane firestop with non-combustible fireblocking- NCDol

Figure 5- [Firestopping](#)

This document does not constitute an evaluation of any vendor's product nor does this document imply that the Code Enforcement Official must approve any specific material, design, or method.